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Solid-state Copper Speciation in Hydropsychid Caddisflies

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Aquatic organisms contain a variety of intracellular metal-bearing deposits that are collectively referred to as granules [1]. Intracellular granules are heterogeneous in their morphology, elemental composition, and origin. They are typically concentrated in tissues involved in digestion, nutrient storage, or excretion, and probably function in the regulation and excretion of essential and non-essential metals [2,3]. Copper-tolerant insects, including hydropsychid caddisflies, inhabit severely contaminated sections of Silver Bow Creek and the Clark Fork River in Montana. These streams were originally contaminated by the mining operations in Butte and the ore smelter at Anaconda, Montana, which were active between the late 1860's and 1984 and once comprised the largest Cu-producing complex in the United States, and today is one of the most extensive Superfund sites in the nation. In this study, we are interested in understanding Cu bioaccumulation and detoxification mechanisms in resident fauna, hydropsychid caddisflies. Results of sub-cellular fractions obtained by differential centrifugation suggest that the organism may store a significant portion of their Cu body burden into granules. Sequestration of metals in insoluble granules is thought to be a mechanism by which potentially toxic metals can be rendered into a non-toxic form. Our preliminary bulk XANES analyses on total body mass suggest the presence of both Cu (I and II). Detail structural information of Cu in bulk tissues will be further investigated combining bulk and microfocused EXAFS and synchrotron based XRF analyses.

References:

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